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Livestock research in the Central Interior of B.C.

A summary of results 1970-1980

Canada

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A summary of results 1970-1980

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SUMMARY

The Experimental Farm at Prince George carried out a number of pasture and feeding trials using steers over the period 1970-1980. This information is summarized so as to provide information usable to the producers in the Central Interior region of British Columbia. Three pasture projects were all carried out using top level management. This resulted in optimum production for the species, soil and climatic conditions of the years they were undertaken. These trials, for the most part, were used to determine the productivity, in terms of beef, of adapted grass species under a grazing regime, e.g., timothy vs reed canarygrass. The productivity figures also set a standard for livestock producers in the area and form a base from which a producer can calculate his degree of success. We have shown that timothy produces more beef than reed canarygrass and that supplementing steers with barley on pasture produces increased gains and total beef per hectare. Number of pasture days varied from 84 to 135 with beef yield from 300 to 500 kg/ha. A rancher should set a goal of not less than 400 kg/ha given a 100-day grazing season.

Winter feed trials show a superiority of cereal silage over grass legume silage or hay so long as the CP level is 8% and the dry matter digestibility is 55%. Supplementing silage with 43% CP feed to bring the CP level to 12% almost doubled the rate of gain. It was possible to turn off steers that dressed 57% with A1 carcass grading by feeding either grass legume or cereal silage. Rate of gain increased and therefore time on feed was reduced by adding grain barley supplement up to 12% CP. There was no advantage in supplementing beyond that point.

RÉSUMÉ

De 1970 à 1980 la ferme expérimentale de Prince-George a réalisé un certain nombre d'essais sur la paissance et le rationnement avec des bouvillons. Les résultats sont résumés ici à l'intention des producteurs du centre intérieur de la Colombie-Britannique. Des gestionnaires d'expérience ont assuré le déroulement des trois projets de paissance. D'où une productivité optimale des espèces, du sol et des conditions climatiques durant les années où les expériences ont été conduites. Pour la plupart, ces essais visaient à déterminer la productivité des bovins de boucherie et des espèces de graminées dans le cadre d'un régime de pâturage, par exemple la fléole des prés par rapport à l'alpiste roseau. Les statistiques sur la productivité servent également à établir une norme qui permet aux producteurs de la région d'évaluer leur degré de réussite. Les essais révèlent que la fléole des prés produit plus de viande bovine que l'alpiste roseau, et que l'administration de compléments alimentaires sous forme d'orge de pâturage entraîne une augmentation de poids et de quantité de viande bovine totale produite par nectare. Le nombre de jours de paissance variait de 84 à 135, avec un rendement en viande bovine de 300 à 500 kg/ha. L'éleveur ne devrait pas fixer son objectif à moins de 400 kg/ha pour une campagne de paissance de 100 jours.

Les essais de rationnement en hiver montrent que l'ensilage de céréales donne de meilleurs résultats que l'ensilage de graminées-légumineuses ou de foin lorsque la teneur en protéine brute est de 8 % et la digestibilité de la matière sèche de 55 %. L'addition à l'ensilage de compléments alimentaires à 43 % de protéine brute, pour amener la teneur en protéine brute à 12 %, fait presque doubler le gain de poids. Il a été possible de produire des bouvillons avec un rendement en carcasse de 57 %, dans la catégorie A1, en les nourrissant à l'ensilage de graminées-légumineuses ou de céréales. L'incorporation d'un complément d'orge aux aliments, pour amener la teneur en protéine brute à 12 %, a entrainé une augmentation plus rapide du poids et a permis de réduire la durée du rationnement. L'addition d'autres compléments n'a apporté aucun avantage supplémentaire.

LIVESTOCK RESEARCH IN THE CENTRAL INTERIOR OF B.C.
INTRODUCTION

In order to place a proper perspective on livestock production in the area it seems appropriate to present a few statistics taken from Central Agricultural Region Report of Project 271024, A.R.D.S.A., 1980. The Central region (Fig. 1) covers a total of 35 million ha. Of this, 70,000 are cropped and 40,000 are pastured. This represents about 29% of the Provincial agricultural holdings. Average farm size is 215 ha and average capitalization is $155,000 with 12% investment in livestock. The report emphasises that the major agricultural activity is beef production involving 85% of the regions farmers. The beef herd has remained fairly stable up to 1980 at around 90,000 for all classes, which is 14% of the Provincial total. Since 1980 a drop in numbers has been evident. Cash farm receipts for beef in the Central region are reported at 12 million dollars.

Up until 1977 development of farm land was being carried out at 6000 ha per year. Because of the escalated land clearing cost this has diminished and it now seems a more economical choice to intensify production on developed land. If intensification is to be carried out high levels of management for the beef herd and full utilization of pastures and feed sources is of paramount importance. It is for this reason that information given in this publication is particularly appropriate at this time.

The purpose of this bulletin is to present a summary of results from livestock research carried out by Agriculture Canada in Central British Columbia from 1970 to 1980. The majority of the projects were carried out at the Prince George Experimental Farm.

Prince George, located at the junction of the Nechako and Fraser rivers, is the hub city for North Central B.C. (Fig. 1).

To the north, lies the fertile grain country of the Peace River area; south the ranches and dry-land ranges of the Cariboo; east the agriculturally rich Robson Valley; and west the productive Vanderhoof, Francois Lake and Smithers areas.

The soil at the Prince George Experimental Farm is a heavy gray luvisol (Pineview clay) common to much of the area. Annual precipitation at Prince George averages 628 mm 40% of which falls between May and August. The average killing frost free period is 119 days. Climatic fluctuations from year to year have a profound effect on both pasturing and livestock feeding. Because of this a summary of both precipitation and monthly mean temperatures is included for the period under discussion (Table 1). This may be useful in order to help interpret some of the results.

From 1970 to 1978 the research was carried out by Mr. K. Dawley who was superintendent of the Experimental Farm during those years until his untimely death in August 1978.

The author wishes to acknowledge Mr. Dawley's contribution as well as that of S. Wright and Dr. Lyle Rode who summarized data and made suggestions for the manuscript.

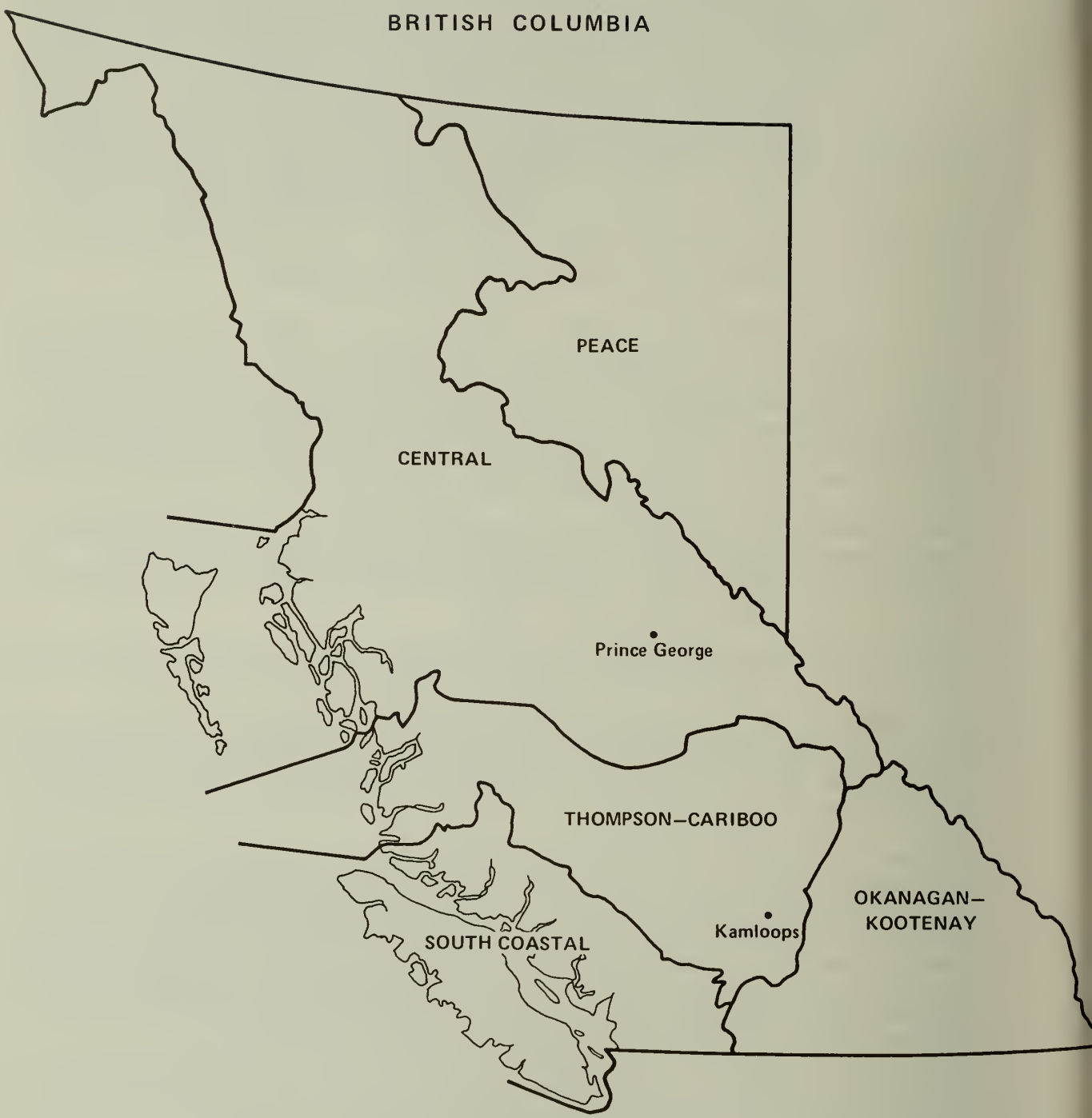

Figure 1. Map of British Columbia showing central region and location of Prince George.

Table 1.

CLIMATIC SUMMARY, PRINCE GEORGE 1970-1980 MONTHLY PRECIPITATION MEANS mm

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
1970	56	19	47	20	79	15	73	47	56	24	61	43	540
1971	67	18	26	17	30	74	84	33	61	68	40	71	590
1972	60	44	60	26	5	108	95	44	29	52	53	76	651
1973	20	33	36	21	84	85	50	48	63	97	66	68	675
1974	91	49	55	28	65	42	97	24	46	55	34	44	630
1975	51	16	51	11	44	88	43	86	23	38	94	42	586
1976	79	40	50	24	78	122	81	69	41	53	28	83	748
1977	40	19	31	26	65	54	110	52	66	24	36	42	565
1978	29	8	53	18	44	37	38	63	52	49	46	50	488
1979	26	81	16	18	72	73	25	32	50	53	3	73	522
1980	18	29	55	22	66	84	83	106	85	32	19	121	722
Long Term 30 yr	57	39	37	27	47	67	60	68	59	59	50	57	628

MONTHLY TEMPERATURE MEANS C 1970-1980

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Mean
1970	12.8	2.1	0.4	3.9	8.3	14.3	14.5	14.3	8.5	4.9	6.6	12.3	2.9
1971	11.2	5.4	2.7	5.5	9.7	12.7	15.9	16.0	8.2	3.1	0.5	15.3	3.1
1972	16.5	10.3	0.6	2.9	10.3	12.9	14.1	14.4	7.7	3.1	1.5	11.6	2.2
1973	8.7	6.2	2.1	4.4	9.8	11.7	14.5	12.5	9.1	3.8	8.7	5.8	2.9
1974	15.2	3.2	2.3	5.4	8.2	12.5	13.7	15.4	11.1	5.2	2.7	3.0	4.3
1975	9.6	12.4	4.0	2.9	8.7	12.1	17.1	12.6	10.4	4.9	4.2	6.4	2.7
1976	6.2	6.0	2.9	5.1	9.0	10.9	13.8	14.4	10.9	4.4	0.7	3.3	4.3
1977	7.4	0.6	0.4	6.7	9.3	13.0	14.1	15.6	8.6	5.2	4.5	14.3	3.9
1978	12.7	5.0	0.2	6.0	8.6	13.0	17.0	14.2	9.3	6.3	5.9	11.1	3.3
1979	18.2	12.7	1.1	4.1	8.7	12.5	16.0	16.1	11.1	6.1	3.3	5.8	3.0
1980	13.4	4.2	2.2	7.0	10.7	13.5	14.3	12.7	9.8	6.2	1.0	8.1	3.9
Long Term 30 yr	12.1	6.1	1.8	4.3	9.3	12.9	15.1	14.1	9.7	4.8	2.9	7.9	3.3

____ means minus (-)

PASTURE TRIALS

Pasture Fertilizer Comparison

In the spring of 1970, a co-operative pasture management project was undertaken by the Prince George Experimental Farm, the B.C. Ministry of Agriculture and Food, and a private farmer in the Giscome area.

This study was designed to investigate the biological and economical advantages of nitrogen (N) fertilization and grain supplementation in pasture management. The project was undertaken on three established pastures (2.5 ha) composed of a mixture of bluegrass, reed canarygrass, sedge species and small amounts of alsike and white clover. The soil base was a Giscome silt-loam complex with a high water table in spring with the pasture drying out in fall. Pasture treatments were:

1. unfertilized pasture (control)
2. pasture fertilized at 112 kg/ha N
3. fertilized as in (2) by with 0.9 kg of rolled barley per head per day supplementation

The evaluation of production was based on a constant stocking of 0.4 "tester" animals per hectare and additional "put and take" animals as required to maximize utilization of pasture growth. Measurements of average daily gains (ADG) were based on tester weights while stocking rates and total production calculations were based on tester and "put and take" animals. The tester steers were randomly allotted to the three treatments, animals were stocked by breed and weight class. Forage intake was calculated by subtracting the yield of forage from a number of grazed sites from the yield of forage taken from grazing exclosures or protected plots.

Grazing was initiated on the test pastures on May 2 and terminated after 135 days. Animal performance and forage intake is shown in Table 2. It is apparent that increased animal gains occur as a result of N fertilization. This increase is further complemented by grain supplementation. It should be noted that periodic weighing indicated a loss of weight in the last grazing period from August 10 to September 14. Animals on fertilized pastures sustained a net loss of -0.8/kg per day, -0.4kg on the control pastures and zero weight change on the pastures with grain supplementation. This would indicate a need for higher levels of supplementation late in the grazing season or earlier termination of the grazing season due to the rapid decline in pasture quality late in the summer.

Measurements of forage consumption reveal higher forage intake levels with fertilization, and even higher consumption in the grain supplemented pastures. Conversely, the amounts of forage dry matter required per unit gain decrease with fertilization and further still with supplementation. The effect of fertilization toward increasing pasture productivity has been observed in similar studies elsewhere.

Supplementation with grain may serve to meet a portion of the animals requirements. It is interesting to note that if the 0.73 kg of dry matter due to grain supplementation is accounted for, the total dry matter (DM) required per unit gain is less for animals receiving supplementation than for those on other pastures. This increased efficiency coupled with increased forage intake was responsible for improved ADG as well as higher stocking rates.

Some relevant economic considerations are included in Table 2. The calculations are based on 1983 values and pertain to basic material costs only. It should be noted that costs associated with the additional labour, and machinery costs of fertilization are not calculated and should be subtracted from the presented totals, for each individual situation, to arrive at a total variable cost for these management alternatives.

Animals receiving grain supplementation were observed to have a higher degree of finish than unsupplemented animals. Although there was economic benefit to supplementation, it is not known if maximum productivity can best be obtained

Table 2

1970 GISCOME PASTURE MANAGEMENT STUDY

Parameter	Treatment Control	Fertilizer(1)	Fertilizer & Supp(2)
Pasture Days	135	135	135
Steer Days	908	1390	1390
Av Initial Wt, kg	281.5	281.3	280.7
Av Final Wt, kg	399.3	391.9	420.2
Gain/steer, kg	117.8	110.6	139.5
ADG, kg	0.87	0.82	1.04
Kg DM/ha consumed	5488	7504	8490
Kg/ha beef production	325.8	467.9	590.5
$VALUES (PER HECTARE BASIS)			
beef produced - $1.58/kg	517.55	743.33	937.94
fertilizer costs - 336 kg @ 240/1000kg	--	80.64	80.64
grain - 0.9 kg/ha/da @ $120/1000kg	--	--	61.78/ha
Totals	517.55	662.69	795.52
$/ha over control	+0	145.14(3)	277.97

(1) 112 kg N/ha

(2) 0.9 kg grain/head/day

(3) These values are available to defray costs of equipment, labour, etc. of applying fertilizer and/or providing supplemental grain.

by supplementation through the whole grazing season or by higher levels of supplement during the latter part of the season. It is also not known what the optimum level of supplementation would be. Fertilization at 112 kg/ha of N is advantageous in increasing beef production. The optimum level, however, is not known.

This Co-operative Pasture Management Project has shown that the use of fertilizer and pasture supplementation is beneficial in a pasture beef production system. As in any project of this nature, it has also shown the need for additional research into the optimum levels of fertilization, and the use of pasture supplements.

Timothy-Reed Canarygrass Pastures

The evaluation of forage species ultimately requires some formal livestock performance evaluation. Initially a particular species will be identified as having potential through the evaluation of plot studies followed by animal production studies. In a number of plot trials on the Prince George Experimental Farm the superiority of (Frontier) reed canarygrass over (Climax) timothy in both dry matter production (1600 to 1100 kg/ha) and crude protein levels (CP) (13.5% to 11.5%) has been observed.

FIRST TRIAL

A three year grazing project was initiated in 1970 to investigate the relative productivity of reed canarygrass and timothy in terms of actual beef production. A third comparison was included to study the use of grain supplementation of pasture. The three treatments were:

1. Reed canarygrass
2. Timothy
3. Reed canarygrass plus grain at 1 kg/100 kg beef on pasture

Each treatment of 1 ha was replicated twice. Nitrogen fertilizer was applied to all pastures in split applications of 78 and 33 kg N/ha in early spring and mid-season respectively. Seed heads were removed at initial heading by clipping and this was repeated throughout the season as necessary.

Groups of "tester" animals were randomly assigned to treatments within weight classes at a stocking rate of 2.4 animals per hectare. Additional "put and take" animals were grazed to calculate maximum stocking rates that each treatment was capable of supporting. ADG figures are based on tester performance with the "put and take" animals being incorporated in stocking rate and total beef production (BP) calculations.

Animal performance data for the 1971 - 1973 trial is presented in Table 3. The use of grain supplementation in this trial resulted in ADG and BP figures significantly higher than in unsupplemented pastures. Data was not obtained for timothy pastures with grain supplementation. Although the ADG was not significantly different between the timothy and reed canarygrass, timothy did show a trend toward higher gains. Total beef production from the timothy pastures was significantly higher than that from the reed canarygrass although supplementation on reed canarygrass with 1 kg of barley per 100 kg of beef resulted in higher ADG than either of the unsupplemented pastures.

Table 3.

(CLIMAX) TIMOTHY - (FRONTIER) CANARYGRASS PASTURES

1971 - 1973

	1971	1972	1973	Mean
Timothy				
Days on Pasture	84	110	114	102.7
Steer days/ha	308.6	376.3	407.4	364.2a
ADG kg	0.89	0.96	0.94	0.93a
Beef Production kg/ha	273	361	384	339a
Reed Canarygrass				
Days on Pasture	84	110	114	102.7
Steer days/ha	333.3	392.6	335.8	353.1a
ADG kg	0.89	0.96	0.94	0.93a
Beef Production kg/ha	266	321	300	296b
Reed Canarygrass & Grain*				
Days on Pasture	84	110	114	102.7
Steer days/ha	350.6	491.4	446.9	429.9b
ADG kg	1.05	0.96	1.15	1.05b
Beef Production kg/ha	369	470	513	451c

*Grain supplementation - 1 kg/100 body weight on pasture.

a,b figures within a line followed by a different letter are significantly different ($P<0.05$)

Calculations

$$\text{steer days/ha} = \frac{\text{Steer days per pasture}}{\text{ha per pasture}} \quad \text{(days/ha)}$$

$$\text{ADG} = \frac{\text{Av Final wt testors} - \text{Initial wt testors}}{\text{days on pasture}} \quad \text{(kg/head/day)}$$

Beef Production = Steers days/ha x ADG (kg/ha)

SECOND TRIAL

This project was extended in 1974 - 1976 to look at production levels on both pastures supplemented with 1.4 kg of barley per steer per day. Stocking and production evaluation methods were identical to the 1971 - 1973 project. A significantly higher ADG and beef production per hectare as seen in Table 4, demonstrates the superiority of timothy pastures. It is interesting to note that beef production values on the 1974 - 1976 supplemented pastures are both about 50 kg/ha higher than the 1971 - 1973 values of 339 kg/ha for unsupplemented timothy and 296 kg/ha for unsupplemented reed canarygrass pastures.

The economic of evaluation supplemental feeding on pasture will change annually depending upon the cost of barley and the value of additional beef produced. For the 1971-1973 trial using barley with reed canarygrass and assuming 1983 values of grain at $120/T and beef at $1.58/kg a $155 investment in grain produced $245 in beef/ha. A difference of $90/ha is accrued. From this must be subtracted the costs of extra labour and provision of feeders.

The feed/gain ratio is 12.3 kg barley per kg additional gain which is within an acceptable range for steers on this type of diet. Therefore, the benefits of increased rate of gain and pasture carrying capacity have to be compared to feeding the same grain later in the feedlot.

These two pasture projects show the superiority of (Climax) timothy over (Frontier) reed canarygrass in the production of beef in a pasture grazing system. Supplementation of barley on pasture is also shown to be advantageous in a beef production system at the levels fed.

Table 4.

(CLIMAX) TIMOTHY - (FRONTIER) REED CANARYGRASS PASTURES WITH GRAIN SUPPLEMENTATION* 1974 - 1976

Timothy	1974	1975	1976	Mean
Days on pasture	107	96	132	111.7
Steer days/ha	384.7	387.1	547.7	439.8
ADG (kg)	1.00	0.80	0.89	0.90a
Beef Production kg/ha	385	311	487	394a
Reed Canarygrass				
Days of pasture	107	96	132	111.7
Steer days/ha	384.7	387.1	575.8	449.8
ADG (kg)	0.68	0.74	0.87	0.76b
Beef Production kg/ha	260	288	499	342b

* Grain supplementation - 1.4 kg/steer/day

a,b figures within a row with different letters are significantly different ($P<.05$)

FEEDLOT STUDIES

Much of the grain used in livestock rations is transported into the Central Interior. The economics of finishing cattle in the area has been questioned on the basis of those transportation costs.

Previous research conducted in the region has shown that some annual cereal crops have potential as a high quality finishing ration when harvested at the proper stage of maturity and stored as whole-plant silage.

The feedlot phase of the research program on the Experimental Farm was started in the fall of 1973. The work was directed toward determining if oat-barley silage has a place in feedlot finishing, and, if so, what advantage has this feed over other principal stored forages?

Oat-Barley vs Grass Legume Silage and Hay 1973 - 1974

During the spring of 1973, a 40:60 mixture of Glen oats and Jubilee barley was seeded and fertilized with 23:23:0 at 168 kg/ha. The crop was ensiled when the barley had reached the early to mid-dough stage. Dry matter yield was 8.4 metric tons/ha. A grass-legume stand of timothy and redclover was ensiled at the late head stage for comparison. Grass hay comprised of timothy with some reed canarygrass harvested at the late head stage served as a third comparison. These three feeds were the sole rations for the 83 day trial.

A group of 36 mixed breed steers were allotted by weight and breed to the three treatments (12 animals/treatment). Animal performance and chemical composition of the feeds are seen in Table 5. Animals on grass-legume silage showed significantly higher rates of gain than animals on the oat-barley or hay rations. Estimates of forage quality based on crude protein (CP) and dry matter digestibility (DMD) analysis reveal a suprisingly low quality grain silage with DMD below 50% and CP at less than 6%. In all cases however, CP in levels were below NRC requirements for this class of animal and response was probably due to differences in protein level of the feeds.

This trial was repeated for 157 days during the 1974 - 1975 winter and for 100 days over the winter of 1975 - 1976 to further look at the potential of oat-barley silage.

Analyses of the feeds were carried out in both years (Table 6). The grain silage was cut at a slightly later stage than the silage used in the 1973 - 1974 trial. Cutting at the late dough stage resulted in higher CP levels in the silage. Acid detergent fiber (ADF) was determined for 1975-6 samples only. Being lowest for oat-barley silage and highest for the hay.

Table 5.

ANIMAL PERFORMANCE IN FEEDLOT ON THREE FEEDS (1973-74)

Parameters	FEED		
	Grass-Legume Silage	Oat-Barley Silage	Hay
Days on Trial	83	83	83
Averge Initial Weight (kg)	398	396	396
Average Final Weight (kg)	455	426	422
ADG	0.69a	0.36b	0.31b
Carcass Grades	40% A1	40% A1	60% A1
	40% A2	20% A2	20% B1
	20% B1	40% B1	20% B2
% CP	7.51	5.99	4.70
% Dry Matter	57.0	47.2	46.1

a, b figures within a row followed by the same letter are not significantly different (P=0.05)

Table 6.

FEED ANALYSIS FOR 1974-75 AND 1975-76

Component	Oat-Barley Silage		Grass-Legume Silage		Grass-legume Hay	
	1974-5	1975-6	1974-5	1975-6	1974-5	1975-6
D M, %	38.2	39.4	27.9	24.1	74.2	64.0
DE (Mcal/kg)-dry	130	147	120	115	104	101
Protein (CP)%-dry	8.0	6.6	9.9	12.3	8.2	8.2
Calcium (ca)%-dry	0.18	0.13	0.44	0.64	0.34	0.39
Phosphorus (P)-dry	0.20	0.20	0.22	0.19	0.18	0.15
Fibre (ADF)%	--	26.7	--	38.1	--	47.2
DMD%	56.9	61.3	54.3	57.0	--	--

Animal performance data for both years is seen in Table 7. Animals fed on oat-barley silage had consistently higher ADG than either of the grass-legume silage or hay rations. No significant differences were seen in animal performance between the grass-legume silage and hay. The higher levels of animal performance on oat-barley rations are reflected in the lower percent ADF and higher DMD and energy values of the oat-barley silage as compared to the grass-legume silage. Crude Protein levels are noted to be higher in the grass-legume silage. Calcium and P supplementation on oat-barley silage was necessary to meet animal requirements.

Carcass evaluations from both trial years are seen in Table 7. The high rates of gain attributable to oat-barley silage resulted in over-fat animals both years. Shipping of these animals was delayed to allow for optimum finishing levels on all three feeds. The majority of animals fed on grass-legume silage graded A1. In the 1974-1975 trial about one third of the animals graded B2. In the 1975-1976 trial all animals were graded A1 or A2. Animals on oat-barley silage achieved a proper level of finish sooner than those on either grass-legume silage or hay.

Oat-barley silage has been shown to be a good finishing ration for steers. Grass-legume silage and hay have also been shown to be sufficient to finish steers when fed as whole rations, though rates of gain are significantly slower than those on grain silage.

Table 7.

ANIMAL PERFORMANCE FOR THREE FEEDS (1974-75 AND 1975-76)

Parameter	Feed					
	Oat-Barley Silage		Grass-Legume Silage		Grass-Legume Hay	
	1974-5[a]	1975-6[b]	1974-5	1975-6	1974-5	1975-6
Initial Wt, kg	391	392	374	391	389	395
Final Wt, Kg	489	472	434	459	454	453
ADG, kg/day	0.62[B]	0.80[A]	0.38[C]	0.68[B]	0.41[C]	0.58[B]
Dressing percent.	56.5	56.1	56.8	56.0	57.6	53.9
Marbling score	6.5	6.9	7.3	7.9	6.8	7.1
Loin eye area, in^2	9.8	10.0	9.6	9.4	9.7	9.1
Fat cover, %	72	57	48	41	53	44
Grades A1, %	20	50	92	83	67	75
A2	70	50	--	17	--	25
A3	10	--	--	--	--	--
B1	--	--	8	--	--	--
B2	--	--	--	--	33	--

[a] feeding period was 157 days

[b] feeding period was 100 days

A,B,C means within rows with different superscripts are significantly different ($P<0.5$)

Silage Plus Grain Supplement

Studies on the use of grain silages as finishing rations were continued over the winter of 1977 - 1978. Concern had been expressed over low CP levels in all the tested feeds, and a trial was conducted to investigate the effects of increasing all the feed protein levels to 12% CP with a 32% protein supplement. Grain silage was harvested and ensiled when the barley was in the late dough stage. An 85% timothy - 15% red clover stand was harvested and ensiled when the timothy was in th early head stage, and a portion of the crop was taken as hay at a slightly later stage. The feed analysis is presented in Table 8.

Three forages were fed with or without supplementation in a 3 x 2 factorial design. Fifty-four yearling Hereford steers were randomly allotted to the six treatments. Animals were fed for 145 days. Animal performance and carcass evaluation are presented in Table 9.

Table 8.

FEED ANALYSIS FOR OVERWINTERING TRIALS 1977-78 QUALITY MEASUREMENTS

	Hay		Silage			Oat Barley Silage		
Component	77-78	78-79	77-78	78-79	79-80	77-78	78-79	79-80
Dry matter, %	85.7	91.0	23.8	38.0	26	41.1	41.0	45
ADF, %	46.9	34.6	43.1	36.6	38.3	28.9	28.7	29.5
TDN, %	50.0	--	53.0	58.0	57	70.0	70.0	70.0
CP,%	7.2	7.7	10.9	8.4	10.4	8.4	7.3	6.7
Calcium,%	0.19	0.43	0.28	0.35	0.37	0.18	0.1	0.18
Phosphorus,%	0.14	0.13	0.17	0.16	0.20	0.21	0.2	0.20

Table 9.

ANIMAL PERFORMANCE - 1977/1978 WITH AND WITHOUT GRAIN SUPPLEMENTATION TO 12% CP

	Grass-Legume Hay		Grass-Legume Silage		Oat-barley Silage	
	+ supp	control	+ supp	control	+ supp	control
Initial Av. Wt (kg)	396	396	390	384	398	396
Beef gained (kg)	38	17	59	33	92	61
ADG (kg/day)	0.23	0.10	0.36	0.20	0.56	0.38
Grade A1	4	3	4	4	2	2
A2	--	--	--	--	1	2
A3	--	--	--	--	1	--
B1	--	1	--	--	--	--
Avg. Dressing %	53.5	53.0	54.0	54.4	56.7	56.4

Supplementation to the 12% CP level resulted in significantly higher rates of animal gain with all three forages ($P<.05$). Animal performances on the basis of feed type was significantly different ($P<.05$) with oat-barley silage producing the highest rates of gain and grass-legume hay the lowest. Carcass evaluations are cosistent with the two previous years showing overfat animals on the grain silage. This is a direct result of maintaining the finished animals on grain silage while waiting for those on the other feeds to catch up. Grass-legume silage and hay is again shown to produce top grade carcasses at the expense of extended feeding periods.

Overall ADG for the previous feeding trials were low. It was hypothesized that although protein levels were adequate, destruction of Vitamin A in the silages may have been responsible for restricting forage intake.

Silage and Vitamin A

During 1978-1979, a study was conducted comparing the three forages supplemented to 12% CP with and without added Vitamin A. Forty-two animals were injected with 2.5 million IU of Vitamin A at the start of the trial and half the animals received one million IU of Vitamin A per head mixed into their feed in powder form every two weeks. The results shown in Table 10 are consistent with previous years in demonstrating the superiority of grain silage over grass-legume feeds. There was no significant benefit ($P<.05$) from the additional Vitamin A supplementation over the 150 day trial. Animal performance was again disappointing and further efforts were directed towards evaluating the energy content of high forage finishing rations.

Table 10.

ANIMAL PERFORMANCE - 1978-79 WITH AND WITHOUT VITAMIN A FEED SUPPLEMENT

	Grass-Legume Hay		Silage		Oat-Barley Silage	
	+ supp	- supp	+ supp	- supp	+ supp	- supp
Initial wt kg	356	352	356	354	356	356
Beef gained, kg	59	60	57	55	99	102
ADG, kg/day	0.52b	0.53b	0.50bc	0.48c	0.87a	0.90a
Grade A1	6	5	7	4	7	7
B1	1	2	--	3	--	--
Avg. Dressing %	54.6	53.4	53.7	54.3	57.2	56.8

+ supp = with Vit. A. supplement
- supp = with no Vit. A. supplement
a, b, c, means within a row followed by the same letter are not significantly different (P = 0.05).

Levels of Supplement

During the winter of 1979 - 1980, oat-barley or grass silages were supplemented to 12% CP, with additioal rolled barley provided at three levels. The two silages were of slightly better quality than those of the previous year and similar to those of 1977 - 1978 (Table 8). Eight steers, randomly assigned to each of the six treatments, averaged 368 kg at the start of the trial.

Seventeen animals were slaughtered 107 days from the start of the trial. Remaining steers were slaughtered at the end of the 162 day feeding period. Due to the lack of slaughter facilities, it was necessary to ship animals in groups. This resulted in animals on the barley silage becoming overfat. This resulted in lower grades for this group. Animal performance data is seen in Table 11.

Oat-barley silage gave the highest rates of gain. Additional barley levels resulted in no significant response with grain silge. Improvement in ADG with grass-legume silage was observed only at the highest level of barley supplementation. It should also be noted that dressing percentages were also highest with grain silage.

Table 11.

ANIMAL PERFORMANCE 1979-1980 WITH TWO LEVELS OF ADDITIONAL BARLEY ABOVE 12% CP

	Oat-Barley Silage			Grass-Legume Silage		
Barley (kg/head/day)	0	0.91	1.82	0	0.91	1.82
Initial av. wt	371	364	367	364	365	360
Beef gained (kg)	145	132	130	83	90	103
ADG (kg/day)	1.07a	0.98a	0.96a	0.56b	0.58b	0.70
Avg. dressing %	57.7	58.6	58.4	55.5	57.0	56.4
Grade A1	1	1	2	7	7	8
A2	3	2	4	--	1	--
A3	3	4	1	--	--	--
A4	1	1	1	--	--	--
B1	--	--	--	1	--	--
Total DM Intake (kg)	1601	1660	1718	1441	1560	1681
Feed Conversion Ratio	11.08	12.34	13.23	17.33	17.34	16.28

1 means within a row followed by the same letter are not significantly different (P = 0.05).

SUMMARY AND CONCLUSIONS

From pasture trials it may be concluded that N (nitrogen) fertilizer is essential to assure good steady growth of grass. Use of N stimulates the growth of grass in the spring. It may be applied either in the spring or in the fall. In most years second applications may be made in July when production drops off. In the Giscome trial N fertilizer gave $145/ha of beef over the control. In northern areas of cool soils N application is the key to pasture management. Grain supplementation on pasture produces greater gains and also improves carcass quality. It will depend upon the cost of grain and the price of beef if supplements should be fed on pasture.

All pasture trials showed timothy to be a superior pasture species to reed canarygrass, even though the later outproduces timothy in plot trials. It should never be assumed that one species or mixture is superior to another as a pasture until it has been evaluated using grazing animals.

A number of winter feed trials have shown superiority of oat-barley over grass-legume silage where CP levels are at the required 12%. Top grade carcasss are produced by these feeds as well as for supplemented hay. Rate of gain is greater for the cereal silage. It was shown that where CP is maintained at 12% additional barley did not increase production from cereal silage but it did when provided above 1 kg/head/day to animals using grass-legume silage. This effectively raised the energy levels of the feed resulting in increased gains.

In all winter feed trials it is important to supply calcium and phosphorus to supplement low levels in the forage. Salt should be available and a good supply of water is essential.

Based on these and other studies as well as many years of observations and experience further recommendations for pasturing and feeding beef steers may be made for Central Interior Region of B.C.

For Pasturing Steers it is recommended that:

1. A weed free firm seedbed must be prepared.
2. Adequate levels of nutrients be available in the soil according to soil test N & P should be at 60 and 80 Kg/ha.
3. Seeding be carried out in May or early June.
4. Seedbed should be packed following seeding or use of "brillion type" seeder.
5. Certified seed of adapted varieties of grass are used. On clay soils seed 8 - 10 kg/ha of timothy (Champ or Salvo which have good regrowth). Where drainage is good use Kay orchardgrass at 10 - 12 kg/ha.
6. A new forage stand usually needs to be clipped once in August to discourage weeds.
7. Pasture may be lightly grazed in the year of seeding but more often than not is only grazed the year following.
8. Pasture should be topdressed with 50 - 100 kg/ha of N fertilizer either late in the fall or early in the spring of the year it is grazed.
9. Grazing can commence about the middle of May or when the grass is 20 cm high.

10. If possible use sufficient animals to quickly utilize a pasture (two weeks) then rotate, use a 2-3 pasture rotation. 2.5 steer units/ha is an efficient stocking rate.
11. Mid-way through the grazing season (early July) a top dressing of 50 kg/ha of N is beneficial.
12. Animals may be supplemented on pasture using rolled barley, for increased rate of gain. 1 kg/100 kg of body weight is a good level to feed.
13. When pastures "run down" in late summer steers may be fed either hay or silage on the pasture so as to prevent overuse of the forage.
14. Animals should be removed from pasture when grass is no longer actively growing.

For winter feeding yearling steers.

1. Good grade silage is best. Cereal silage usually has low CP levels but good TDN values while grass legume silage is the other way around.
2. A good silage crop may be grown by mixing barley and oats. Use high yielding adaptable varieties (gateway 63 or galt barley with random or pendek oats seeded at 60 and 40 kg/ha. Trapper or Century field peas may be used in place of oats.
3. Seeded on a well prepared seed bed and check to see that soil fertility is adequate. Use up to 80 kg/ha of a N P or NPK fertilizer drilled with the seed.
4. Remove cereal silage crop at early dough stage and a grass legume crop at early flower.
5. Attempt to ensile at 30% dry matter. Wilt if necessary.
6. Have your silage tested for protein and digestible dry matter (energy). A good level is 10-12% CP and 60-65% TDN. If under these levels then silage should be supplemented.
7. Long yearling hereford and angus steers should finish at 460 kg, cross bred British breeds at 500kg and exotic crosses at 550kg approximately.
8. A gain of 0.8-1.0kg per day should be the aim for using silage plus supplement as suggested.